

INTERNATIONAL ENVIRONMENTAL AGREEMENTS: A Survey of Their Features, Formation, and Effects

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■ **Abstract** International environmental agreements (IEAs), legally binding inter-governmental efforts directed at reducing human impacts on the environment, are common features of global environmental governance. Using a clear definition allowed creation of a comprehensive database [available online at (31)] listing over 700 multilateral agreements (MEAs) and over 1000 bilateral agreements (BEAs), which included treaties, protocols, and amendments that address numerous pollutants; preservation of many species; and, increasingly, protection of various habitats. Research into the factors that explain the timing, content, and membership in environmental agreements clarifies that the interests and power of influential states create pressures for, or constraints on, progress in global environmental governance but that discourse, actors, and processes also play important roles. Variation in the effects of these agreements on environmental behaviors and outcomes often depends as much on characteristics of member countries, the international context, and the underlying environmental problem as on the differences in agreement design.

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INTRODUCTION

Since at least the late 1800s and with increasing regularity in the past half century, countries have negotiated hundreds of international legal agreements to address environmental problems they cannot resolve alone. Conventions addressing ozone depletion, climate change, and biodiversity are well-known, but governments have also concluded global, regional, and bilateral agreements to mitigate pollution of oceans, regional seas, rivers, and lakes; reduce over-exploitation of numerous species of fish, birds, and land and marine mammals; and slow the degradation of wetlands, deserts, and other habitats. This review surveys the landscape of such agreements, offering a precise definition of international environmental agreements (IEAs) to allow description of over 700 multilateral agreements (MEAs) of three or more member countries and more than 1000 bilateral treaties, conventions, protocols, and amendments (BEAs) designed to protect the environment.

After this survey, the review discusses the research on factors that influence the successful negotiation of IEAs. Why have countries quickly negotiated significant agreements to address some environmental problems while they have made few attempts, or have failed, to address others? An agreement’s negotiation, timing, and content are functions of the perceived urgency and desirability of resolving the problem in a particular way, with those perceptions being functions, in turn, of material aspects of the problem’s causes and consequences as well as political, economic, and social characteristics of the countries relevant to its resolution. Next, the review discusses research on the effects of IEAs, which has identified some that have had significant impacts on human behaviors and environmental quality and others that have had few such impacts. Scholars have examined only a small subset of extant IEAs, which precludes any general claims about their effectiveness. Research to date does suggest, however, that the ability of an IEA to induce positive changes depends less on ensuring that agreements contain particular rules or specific monitoring and enforcement provisions and more on ensuring that agreements contain provisions that are responsive to the type of environmental problem being addressed, the countries involved, and the exigencies of the international context in which they must operate.

Before proceeding, a caveat is in order: Although this review focuses on international environmental agreements, such arrangements are only one of the many environmental protection strategies currently in use. The United Nations (UN) has recently urged the supplementing of intergovernmental treaties with voluntary efforts, such as the “Global Compact” for “responsible corporate citizenship” and “type 2 partnerships” between governments and nongovernmental organizations

(NGOs) (1, 2). But many actors have not needed such encouragement and are taking individual and collaborative action at subnational, national, supranational, and transnational levels (3, 4–7). On climate change alone, corporations are trading CO₂ emissions, local governments are setting municipal emission targets, NGOs are developing carbon sequestration projects, and individuals are practicing energy conservation, in many cases long before actions by national governments. These and similar efforts are likely to contribute much to a global transition to sustainability and deserve considerable analytic attention (8). That said, the present review of legally binding intergovernmental efforts and research done on them sheds light on an important element of global efforts to better manage the relationship of humans to the natural environment.

DEFINING INTERNATIONAL ENVIRONMENTAL AGREEMENTS

Despite extensive public, legal, and social science interest in international environmental agreements, the empirical basis for claims regarding the number of such agreements and their characteristics remains weak. The web and most law libraries have numerous lists of international environmental laws. But comparing these lists reveals considerable variation in what each means by these terms. Many identify only selected, important, or major agreements or those related to a particular region or issue (9–17). Some combine binding (or *hard law*) treaties and conventions with nonbinding (or *soft law*) statements of principles, declarations, and resolutions (18). Most secretariats and even the UN-affiliated websites of the UN Environment Programme (UNEP), the UN Food and Agriculture Organization (FAO), and the UN International Maritime Organization (IMO) list only agreements negotiated under their auspices or that they administer (19–21). Governments usually list only those agreements to which they are a party (22, 23). Nominally comprehensive lists often overlook well-known environmental agreements, and almost none systematically identify the many protocols, amendments, and other modifications needed to reconstruct the historical development of international environmental law or its status at a particular point in time. Web-based lists are often not kept current (24, 25). Most do not provide users with (or worse, do not themselves use) systematic and explicit definitions and corresponding rules to include or exclude agreements. And many that do, including a particularly comprehensive list, include agreements that are not obviously environmental on the grounds that their environmental effects are hidden in the language of the agreement (26–28).

The variation in the coverage of international environmental law lists surely reflects (and may well serve) the purposes and audiences of those creating these lists but makes it difficult to address the seemingly straightforward task of accurately describing, let alone analyzing, the historical development and current status of the population of IEAs. Even the excellent ECOLEX database of environmental law developed by the World Conservation Union, UNEP, and FAO and the

Environmental Treaties and Resource Indicators database developed by Columbia's Center for International Earth Science Information Network have not produced definitive or complete lists of international environmental agreements (29, 30).

The present review seeks, in part, to remedy this state of affairs by proposing a clear, explicit definition of international environmental agreements that conforms reasonably well to common understandings of that phrase and using that definition to identify and describe the agreements that fit it [the list is available at (31)]. In this review, the definition of an *international environmental agreement* is an intergovernmental document intended as legally binding with a primary stated purpose of preventing or managing human impacts on natural resources. Providing a clear and explicit definition allows even readers who disagree with it to make sense of the discussion that follows and to identify whether the summary given here would need to be expanded or contracted to conform to their preferred definition.

What is an *agreement*? When used as part of the phrase international environmental agreement, the term usually corresponds closely to the 1969 Vienna Convention on the Law of Treaties' definition of a treaty, i.e., "an international agreement concluded between States in written form and governed by international law" in which states express a "consent to be bound" [Articles 2(1)(a) and 11 through 17] (32, p. 14). For most legal scholars, it is the consent to be bound that is crucial: Agreements are the documentation of legally binding arrangements among two or more states, regardless of whether they are designated as treaties, conventions, accords, or modifications of such arrangements (32).

The difficulty arises, of course, "not with the definition itself, but whether a particular instrument or transaction falls within the definition" (32, p. 14). I operationalized the definition to consist of:

1. instruments designated as convention, treaty, agreement, accord, or their non-English equivalents, and protocols and amendments to such instruments;
2. instruments, regardless of designation, establishing intergovernmental commissions;
3. instruments, regardless of designation, identified as binding by reliable sources (e.g., by a secretariat, UNEP, or published legal analysis); or
4. instruments, regardless of designation, whose texts fit accepted terminologies of legally binding agreements (32, p. 404).

I intentionally exclude intergovernmental soft law, such as action plans, agreed measures, codes of conduct, declarations, resolutions, and similar policies because they are not binding and also exclude the large number of European Union (EU) directives because they are distinct in several important ways from other international agreements (14, 33–35).

By clearly defining the term agreement, I seek to provide an accurate count and description of the range of distinct legally binding environmental commitments governments have made. A definition that includes protocols, amendments,

and other binding modifications as well as the original agreements they modify will find more agreements than one that excludes such modifications. States generally employ original agreements when pursuing major new policy objectives, employ protocols for new but related policy directions, and employ amendments for relatively minor modifications to existing agreements. But there are many exceptions to this general rule. Therefore, to exclude modifications would understate the number of significant IEAs by ignoring commitments, such as the eight protocols to the Convention on Long-Range Transboundary Air Pollution (LRTAP), the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), and the amendment to the International Convention for the Regulation of Whaling that halted commercial whaling. On the other hand, including all modifications overstates the number of significant IEAs by counting many minor, noncontroversial, or technical amendments. The approach taken here addresses these issues by using a broad definition that includes modifications while also distinguishing between the number of original agreements and the number of all legally binding agreements.

What is international? Although *international* can have broader meanings, when referring to IEAs, the term usually means intergovernmental. I operationalized this definition to include all agreements to which governments of two or more states have (or are allowed to) become parties but exclude instruments between single governments and either international organizations or NGOs and instruments between or among international organizations, corporations, or NGOs.

What is environmental? Environmental is the most difficult of the three elements of the phrase to define in a commonly accepted way. Most of the divergence noted among IEA compilations stems from environmental being “a term that everyone understands and no one is able to define” (36, p. 170; 37, p. 4). Indeed, two authors who analyzed UNEP’s compilation of IEAs rejected eight as having “no significant environmental content” (38, p. 404). The definition used here seeks to categorize agreements in ways that correspond to most scholars’ and practitioners’ categorizations of environmental and nonenvironmental. The definition intentionally errs in being too broad (assuming those with narrower definitions can discard included agreements more readily than they can identify excluded ones) while trying to avoid including agreements most scholars and practitioners would not classify as environmental.

This review defines agreements as *environmental* if they seek, as a primary purpose, to manage or prevent human impacts on natural resources; plant and animal species (including in agriculture); the atmosphere; oceans; rivers; lakes; terrestrial habitats; and other elements of the natural world that provide ecosystem services (39). *Primary purpose* was operationalized by searching for terms corresponding to this conception in agreement titles, preambles, or articles specifically designating agreement goals [for search terms used, see (31)]. This excludes agreements addressing human health, conflict, cultural preservation, trade, oceans, outer space, nuclear radiation, transportation, weather, labor, and similar issues unless those agreements addressed environmental issues as a primary concern. The definition

also excludes agreements whose effects are environmental, if that was not a primary purpose. A broader definition that includes agreements based on their having environmental effects, like that adopted by Burhenne, captures agreements on trade, regional economic integration, worker protection, and arms control (26). There may be considerable value in this expansive definition, but it (a) diverges significantly from common usage and (b) has the analytic drawback of requiring that agreement effects be identified before they can be categorized as environmental and, if used literally and consistently, of precluding analysis of why some environmental agreements fail (because those that have no environmental effects would be defined as not environmental). The more restrictive, purpose-based definition used here skirts these problems and also allows analysis of how, if at all, agreements intended to address environmental degradation differ from those intended to address other topics of international concern.

DESCRIBING THE POPULATION OF INTERNATIONAL ENVIRONMENTAL AGREEMENTS

What does the population of cases that meet this definition look like? This section provides a midterm report of initial, nondefinitive, descriptive statistics regarding this population of IEAs based on a recently developed database; the list of agreements composing the IEA database will be maintained and updated at Reference 31. An initial list of over 3500 unique instruments relevant to international environmental protection was compiled from over 30 print and electronic sources, and the websites of over 150 environmental treaty secretariats and 25 environment or foreign affairs ministries [sources are listed at (31)]. Careful application of the present inclusion rules, which was stricter than many contributing lists, eliminated approximately 675 documents as nonbinding, approximately 250 as nonintergovernmental, and approximately 1050 as nonenvironmental. The resulting list of IEAs seems likely to have identified an almost complete set of over 700 MEAs (between three or more governments) and a far less complete, but still large, subset of over 1000 BEAs (between two governments).

Multilateral Agreements

The list of IEAs allows relatively confident claims to be made about MEAs. At least 729 MEAs fit the IEA definition, far more than UNEP's 1996 listing of 216 or Burhenne's listing through 1998 of 474 (26,40). This accounting is larger, in part, because it more systematically identifies protocols and amendments. Only half of the MEAs, 357, were original agreements, with 20 percent protocols and 30 percent amendments. Several MEAs were signed but never (or have not yet) entered into force, and over 50 have been replaced by other agreements or terminated. As implied by the discussion of original agreements and modifications above, this does not mean there are 700 fully distinct and separate multilateral commitments. Rather, it means that three or more governments have agreed on legally binding

environmental commitments over 700 times; some are quite distinct from previous commitments, and others involve minor changes to previous commitments.

Connections Among Multilateral Agreements: Lineages and Secretariats

These 729 MEAs are not all independent but are linked to each other in various ways. Much recent scholarship has sought to capture these connections through the concept of international environmental regimes (41, 42). The term *regime* is usually defined broadly as “implicit or explicit principles, norms, rules, and decision-making procedures around which actors’ expectations converge” (43, p. 2). This broad definition recognizes that state behaviors can be influenced by informal, nonbinding understandings as well as by formal legal agreements and that, even where legal agreements exist, the interpretation and implementation of those agreements and their impacts on state behavior often reflect numerous extra-legal factors related to ideas, norms, and the actors mobilized on the issue (44). This broad definition allows the *marine pollution protection regime* to be defined as including only those IMO conventions addressing global marine pollution or, alternatively, as including all international efforts addressing marine pollution, which include these IMO conventions but also include regional seas conventions, bilateral agreements, and related ministerial declarations. Although such breadth is useful for some analytic purposes, it would introduce unnecessary ambiguity into the present effort to clarify, classify, count, and describe IEAs.

Therefore, to group legally related agreements, the term *lineage* is used to refer to one or more legally linked instruments. A lineage is any set of agreements, protocols, and amendments that modify, extend, replace, or explicitly derive from one or more original agreements. For example, the marine pollution (MARPOL) lineage includes a 1954 agreement with 4 amendments replaced by a 1973 agreement and integral 1978 protocol that have been modified by another protocol and 36 amendments. Such lineages are distinct from but often form the basis of regimes. This definition groups the 729 MEAs into approximately 250 lineages. Over 40 percent of all agreements cluster into the largest twenty lineages, each of which has at least 8 instruments. Another 30 percent cluster in 50 lineages of 3 to 7 instruments each. The remaining 30 percent are split; 13 percent belong to 50 lineages that involve an initial agreement and a single modifying protocol or amendment, and 128 agreements (or 17 percent) have never been legally modified.

The larger lineages tend to consist of either frequently modified original agreements or sets of linked agreements. Rivaling the MARPOL lineage in number of agreements, the whaling lineage includes 2 early conventions and 4 protocols, the currently operative 1946 convention that replaced those, more than 50 annual binding amendments of the agreement’s schedule of catch quotas, a 1956 protocol, a 1963 agreement on international observers, and several related bilateral agreements. The UN’s Mediterranean Action Plan (MEDPLAN) generated an original agreement, eight protocols, and three amendments, and the 1979 LRTAP Convention has eight protocols covering various air pollutants. Members

of the 1991 Convention Concerning the Protection of the Alps have negotiated 10 protocols in 10 years addressing, inter alia, sustainable development, nature protection, forestry, agriculture, tourism, soils, energy, and transportation. The 1979 Convention on the Conservation of Migratory Species of Wild Animals (CMS) has been amended three times, but it has also facilitated negotiation of six new agreements on seals, cetaceans, albatrosses and petrels, waterbirds, and bats (the last of which has been amended twice) and six nonbinding memorandums of understanding (MOUs) on other species.

Although multi-agreement lineages usually indicate considerable international activity on an issue, the absence of a long stream of legal instruments does not imply a lack of activity. Regimes need not develop only through binding agreements. Most fisheries set catch limits through resolutions, presumably to avoid ratification delays if such limits were made binding. Although the 1949 Convention for the Establishment of an Inter-American Tropical Tuna Commission has been legally modified only once, the Commission has adopted over 40 resolutions in the last 5 years alone, limiting, inter alia, catch, gear, bycatch, and fishing by nonparties. The 1971 Convention on Wetlands of International Importance has only one protocol and one amendment, but annual Conferences of the Parties have adopted numerous recommendations and worked closely with member states to improve protection of wetlands.

As already noted, an agreement's legal designation provides only limited insight into its substantive importance. The choice to establish a convention or treaty as a new original agreement, to negotiate a protocol, or to pass an amendment appears to be driven either by legal requirements in earlier agreements or facets of institutional culture. For example, most agreements admit new members without legal action, but new members have also been admitted through conventions, protocols, and amendments. Enforcement efforts have been codified both in original agreements and in protocols. By contrast, at least one very significant and controversial change, the commercial whaling moratorium, was adopted by amendment. The CMS agreement has used both binding agreements and nonbinding MOUs to protect endangered species. Notably, the two longest lineages (whaling with 70 instruments and MARPOL with 44) both rely on *tacit acceptance* procedures that allow particular types of amendments to enter into force on a given date unless a certain number of parties object rather than when a certain number of parties accept. Agreements that require explicit acceptance (with corresponding ratification delays) for an amendment to enter into force either deter otherwise desirable changes or channel reform efforts into mechanisms that are not legally binding.

Many IEAs that are not part of the same lineage are connected by having been negotiated under a common organization's auspices. Almost 200 agreements have been negotiated under the auspices of UN organizations. The UNEP Governing Council established a Regional Seas Programme in 1974 that has produced over 40 agreements covering 10 regional seas (15). The IMO has fostered not only 44 MARPOL agreements but 10 instruments on oil pollution compensation, 9 on dumping of wastes, and 6 on oil pollution accidents and response. The UN

Economic Commission for Europe facilitated nine LRTAP agreements but also five MEAs addressing transboundary environmental issues and numerous nonbinding regulations on motor vehicles (45). Fifteen agreements with 25 amendments have been concluded under the FAO Constitution (Article XIV), and numerous other IEAs have been concluded through the FAO's regional fisheries bodies and plant protection commissions (19, 46). The Council of Europe, the Benelux Economic Union, and the Association of Southeast Asian Nations (ASEAN) have also promoted development of various environmental agreements.

Most MEAs are managed through a policy-making body of member state representatives (e.g., a Conference of the Parties) and an administrative secretariat that coordinates the efforts of member states. Indeed, the primary goal of many agreements is to establish an organization to manage an environmental problem rather than to promulgate regulations that do so directly. Over 150 secretariats have been established to help manage agreements; some have large staffs actively engaged in formulating and implementing policies, yet others exist in name only [a list of these secretariats is available at (31)]. Many agreements also establish subsidiary bodies, such as the UNFCCC's Subsidiary Bodies for Implementation and for Scientific and Technological Advice or the International Whaling Commission's Scientific Committee.

Substantive and Temporal Patterns in Multilateral Agreements

Given the number of MEAs, it is not surprising that they cover a range of environmental problems. To categorize them involves, by necessity, creating groupings that reflect the perspective of the person categorizing and that cannot be mutually exclusive because many agreements address themselves to multiple environmental issues [for an alternative categorization, see (38)]. Thus, many individual agreements appear in multiple categories in the descriptive summary that follows. Almost half, 348, of all MEAs attempt to protect species or manage human impacts on those species. More than one third of the species-related instruments, 124, relate directly to fisheries and fish protection and management (with 72 original agreements and 52 protocols and amendments), and another 87 agreements, protocols, and amendments relate to other marine animals including whales, other cetaceans, turtles, and fur seals. Other species-specific agreements target polar bears, bats, vicuña (a South American camelid), birds, or wildlife generally. Over time, MEAs have come to focus more on pollution with a recent increase in agreements addressing habitat. Until 1972, less than 20 percent of MEAs, 39 of 221, were pollution related and 67 percent (149) were species related; since then, the adoption rate has been almost exactly even (199 on species, 203 on pollution). More than half of all pollution agreements, 126, address marine pollution, but many address lake and river pollution (a balance that is probably quite different among BEAs). Nuclear pollution from energy production and nuclear weapons has been explicitly addressed in 39 agreements. Although highly visible, MEAs addressing atmospheric pollutants have numbered only 20; these included climate change, acid rain, ozone protection, and air pollution from ships. Although habitat protection was addressed

in agreements in 1900, 1933, and 1940, it has been an infrequent target of MEAs and constituted only about 3 percent of the total (22 agreements).

Although international environmental activity has increased recently, states began cooperating on what we would now consider environmental issues in the nineteenth century. By 1910, three agreements addressing the invasive species of *Phylloxera vastatrix* (a North American insect that devastated the French wine industry), five on European fisheries, two on transport of environmentally harmful materials on the Rhine, one on birds, and one on species and habitat conservation in Africa had been negotiated. Between 1911 and 1945, 21 MEAs were negotiated addressing protection of North Pacific fur seals and whales; fisheries in the Baltic and the Atlantic; and various agricultural issues (including formation of the FAO, locusts, and contagious animal diseases). A 1933 convention calling on governments to establish national parks listed more and less severely threatened species in separate annexes that foreshadowed the approach of the Convention on International Trade in Endangered Species (CITES) 40 years later. After World War II, MEAs were adopted with increasing speed. A prewar rate of an agreement every two years became a rate of seven agreements per year between 1946 and 1972, the year of the UN Conference on the Human Environment (UNCHE). That rate has continued to increase with 319 agreements completed in the 20 years from UNCHE to the 1992 UN Conference on Environment and Development (16 agreements per year), and 189 agreements completed from 1993 through 2002 (19 agreements per year).

Bilateral Agreements

Developing a comprehensive list of BEAs proves more difficult because they often are documented and known about only within the two signatory countries. Listings are generated less frequently than for multilaterals, often by foreign ministries that generally do not make them readily available, separate environmental from nonenvironmental agreements, or, understandably, reproduce them in languages other than those of the signatory states. Thus, a definitive description of BEAs, and hence of IEAs as a whole, must await a more concerted, resource-intensive effort than any yet undertaken. That said, the IEA database has made a significant effort in this direction that makes some description of the population of BEAs possible.

Although this project's IEA database focused initially on identifying multilaterals, it has since identified over 1040 BEAs. This number represents a lower bound of BEAs. An estimate for an upper bound can be arrived at by noting that BEAs exist in approximately a 3-to-1 ratio to MEAs in FAO's FAOLEX database and in work reported by Jacobson & Brown Weiss (47; 48, p. 1). Assuming this ratio holds for the population of IEAs, then the 700 MEAs identified here suggest an upper bound of 2100 BEAs, a number that could be refined through a more systematic accounting. Of the BEAs identified, only 100 (10 percent) are protocols or amendments, a much lower proportion than among MEAs; governments appear to replace BEAs more often than they modify them. Of the BEAs identified, about 30 percent address fisheries; 25 percent address freshwater management; 10 percent

address environmental protection generally; and 10 percent address plant, animal, and agricultural issues. Time trends in BEAs parallel those of MEAs. Already by 1900, 29 had been negotiated, almost exclusively among European states to address river or fisheries management. The 74 BEAs signed from 1901 to 1945 (a rate of 1.5 per year) ramped up quickly to 227 being signed from 1946 to 1972 (8 per year), 389 from 1973 to 1992 (20 per year), and 314 from 1993 to 2002 (32 per year). Even this incomplete dataset of BEAs demonstrates that they play an important and increasing role in global environmental governance, one that has not yet received the same scholarly interest as, and seems likely to differ from, the role of MEAs.

NEGOTIATING INTERNATIONAL ENVIRONMENTAL AGREEMENTS: WHY WE HAVE THOSE WE HAVE

Investigating the causes of, and conditions that foster, negotiation of international agreements, including environmental ones, has been a major focus of international relations research for some time. This discussion switches to discussing environmental regimes to reflect the fact that research on their formation and research on their effects (described in the next section) generally are interested in understanding regimes in the broad sense defined above rather than in the narrower sense of formal legal agreements (49). Much research has focused on why the international community takes up (or ignores) a particular environmental issue at the time and in the form it does (50–55). Neither scientific nor public consensus about a problem's existence, importance, or causes nor efforts by those concerned about a problem are enough to produce international action. Indeed, there appear to be many necessary (or at least facilitative) conditions for the negotiation of IEAs but very few, if any, sufficient conditions. The timing and content of IEAs are influenced by the strength of states' interests in environmental protection relative to other concerns and their power to promote those interests, the knowledge and discourse that structure perceptions of environmental problems and their solutions, and the efforts of individuals and groups in proposing solutions and pressing governments to accept agreements that are on the table.

Interests, Power, and Discourse

Refining more general arguments from international relations, scholars of international environmental politics have sought to understand how the array of interests among states influences the ability to negotiate, and the design of, international agreements. They have proposed various typologies to explain why nations have formed regimes quickly in response to some environmental problems, more slowly in response to others, and not at all in response to yet others (42, 56–59). Despite differences, these typologies all see the ease or difficulty of regime formation as a function of conflicts between the political, economic, and environmental interests of relevant countries. In some environmental problems, the obstacles to agreement stem from a tragedy of the commons in which all countries have mixed

motives, i.e., all want the problem resolved but none want to contribute to its resolution (60). Yet, the obstacles to agreement can be even greater in unidirectional or “upstream/downstream” problems in which upstream perpetrators lack any incentives to restrain their pollution levels, and downstream victims have no credible threats with which to induce such restraint (61). Likewise, problems involving fundamental conflicts over the environmental goal (as in current negotiations on whaling and climate change) tend to resist resolution more than those involving conflicts on the means of achieving a shared goal (as in negotiations to reduce acid precipitants through common targets or differentiated critical loads) (62).

These problem typologies help explain the content, as well as the likelihood, of agreement. In mixed motive problems, any agreement must address the ongoing incentives of members to cheat, i.e., the desire all members have to encourage others to contribute to the problem’s remedy while, secretly, not contributing themselves. In contrast, agreements to harmonize environmental policies among states already committed to environmental protection (say, for domestic political reasons) need only identify the policies members should harmonize to, because the agreement is not addressing member’s incentives to violate but only their need for a rule about how to comply (56, 63). Thus, agreements addressing overexploitation of fisheries (a mixed motive problem) usually have more stringent enforcement provisions than those among, for example, European states to harmonize national environmental policies to facilitate international trade. Further, agreements addressing mixed motive problems usually can rely on reciprocal behavioral commitments (e.g., all countries reducing pollution levels or fish harvests by specified amounts). Such commitments will not resolve upstream/downstream problems: Upstream countries do not benefit from downstream countries reducing their pollution and must be offered side payments or rewards to join and comply (61).

Features beyond the underlying politics of a problem also affect whether agreements are concluded. Highly visible, immediate, and dramatic environmental damage that actors in powerful states care about tend to receive international attention. Thus, marine pollution agreements have addressed oil pollution more often than less visible pollutants, such as chemicals, garbage, or sewage; the relative rarity of agreements on air pollution may reflect the diffuse, difficult to identify, and chronic nature of air pollution’s effects. As the domestic policy literature notes, policy shifts more easily after accidents and crises or during moments of windows of opportunity (64, 65, 110–113). Although crises “are not driving forces like material conditions, interests, or ideas,” they can prompt international action if deeper forces make conditions ripe (53, p. 77). Environmental disasters, such as the Chernobyl nuclear accident and chemical spills on the Rhine, raise public awareness of a problem, produce calls for action, and clear political “space for the consideration of new ideas on how to explain and solve problems” (66, p. 185). Scientific breakthroughs, like discovery of the stratospheric ozone hole, can serve a similar function (67; 68, p. 27; 69). And, when one country or region comes to see an environmental problem as a crisis, other countries also tend to see that problem in crisis terms, which makes international action easier than would have been possible

even months before (54). However, the often chronic environmental problems of developing countries that have long ago been remedied in industrialized countries, such as poor water quality, often receive little international attention (70). Indeed, major oil spills off Europe and North America have often prompted negotiations on marine pollution, yet those off Africa and Latin America have not (71, 72).

Astute politicians and institutions, of course, do not wait for catalytic events but expend "political capital in an effort to persuade others to recognize [certain] issues as priority agenda items" (53, p. 7; 64). Scientists (and the "epistemic communities" they compose) clarify environmental impacts and propose solutions (73, p. 224). Although the legitimacy accorded to science gives global environmental assessments considerable influence, as evident with the Intergovernmental Panel on Climate Change's reports, many still "sink without a trace" (69). International organizations develop expertise and focus resources on certain issues, as with UNEP's Regional Seas efforts and IMO's efforts on marine pollution. And, often, international cooperation on one pollutant or species fosters cooperation in related areas. NGOs provide information, conduct research, and propose and evaluate policies, actions that introduce both ideas and political pressure into negotiations (74, 75). Corporations and other interest groups in agenda-setting states often internationalize domestic issues to avoid the costs of unilateral action by their governments (76). Although domestic political pressures can predispose certain governments to be leaders, leadership in any given case usually reflects an interplay between those pressures and characteristics of the environmental problem (53, p. 7; 54; 76).

Whether these factors produce agreement depends on how governments perceive their political interests and preferences. States become supportive "leaders" or oppositional "laggards" based on an interplay of the environmental "facts" (e.g., whether a state is upwind or downwind), the economic impacts of action and of inaction, and the way these factors are perceived by domestic political audiences (77, p. 78; 78). These basic preferences are influenced, in turn, by policy styles, party politics, bureaucratic structures, and transnational linkages (76, 79, 80). If interests and preferences vary from state to state, the constellations of interests among states also vary from environmental issue to environmental issue, with many involving multiple, overlapping types of problems. Thus, states concerned about a particular pollutant may face a tragedy of the commons problem among themselves and an upstream/downstream problem with polluting states that do not share their concern (62, 81).

State's goals for negotiations also influence how quickly they succeed. Framework conventions, cooperative research programs, or nonbinding resolutions may reflect universally low concern, an inability to resolve conflict between concerned and unconcerned states, or high concern but uncertainty about how best to address the problem. Disputes over the solutions proposed can cause as much resistance to agreement as disputes about whether the problem needs resolution. Even efforts that are relatively unambitious ecologically may be strongly opposed if they impose high costs on powerful states or influential economic actors. Thus, the climate convention has met considerable resistance because of the costs it requires states to

incur, despite the fact that its emission targets fall far short of what climate experts consider necessary to avert climate change.

Although states have no obligation to join any agreement, membership is not always fully voluntary. A powerful state, or group of states, can impose regimes or make membership more attractive than non-membership (82, pp. 84–86; 83). Over the past quarter century, a combination of threats of American economic sanctions and public outcries have caused many whaling states, often reluctantly, to join the whaling convention, to reduce their opposition to a moratorium on commercial whaling, and to remain members of an agreement many view as increasingly ignoring their interests (84, 85). Power may reflect general economic or military power or more issue-specific power from the ability to influence outcomes if no agreement is reached or from voting and bargaining strength within a regime (86). Thus, China and India refused to join the ozone regime until industrialized states codified financial transfers (87). Brazil can block progress on tropical rainforest protection, as Botswana, Namibia, and Zimbabwe can on elephants. In contrast, if states responsible for a problem share a desire to resolve it, spontaneous patterns of social practice may make legal agreements unnecessary (82, pp. 84–86).

Although interests matter, IEAs are not simply aggregations of states' "well-developed conceptions of their own interests" (53, p. 97). Preferences can be unclear and unstable in environmental arenas in which knowledge is uncertain, issues are complex, and material interests are "weakly or ambiguously affected" (88, pp. 132–133). High levels of uncertainty can make interests and preferences hard to identify, sometimes hindering and sometimes facilitating agreement (63). Bargaining persuades as well as communicates interests, threats, and promises, and it alters perceived interests and whether and what type of regimes form (63). Framing a problem as global gives "every participant in the negotiation process real bargaining leverage" and veto power (53, p. 14). Framing the problem as regional may facilitate evolutionary progress, as evident in UNEP regional seas agreements and regional plant protection agreements. In short, how things are discussed, not just what is discussed, matters.

Actors and Processes

Within the constraints of interests, power, and discourse, actors and processes still influence when and what agreements get signed. Although different scholars have focused on states, secretariats, epistemic communities, NGOs, domestic political constituencies, and individual leaders, the similarities in their lists of how these different groups influence the negotiation process suggest functional distinctions may be more useful (75; 89; 90, p. 18; 91). Those who understand environmental trends and their causes can motivate negotiators by causing them to reestimate the costs of reaching, or failing to reach, agreement. When claims by other governments are suspect, policymakers often seek advice from scientists, international organizations, and NGOs they perceive as more impartial (75, p. 727; 90, p. 12). Indeed, many NGOs seek out resources and expertise to supplement traditional

advocacy with impartial information provision. NGOs also provide negotiators insight into, and influence on, various constituencies' perceptions of environmental issues (74, p. 217).

At local, national, and international levels, NGOs, industry trade groups, and even scientists lobby, promote media coverage, campaign, protest, or engage in ecosabotage to raise issue salience. By providing information on the progress of international negotiations to constituencies, environmental NGOs and corporations create pressure to succeed in environmental negotiations (6, 7). States grant NGOs (e.g., the Earth Negotiations Bulletin) access to negotiations to get detailed daily reporting but accept, in exchange, dissemination of that reporting, which can increase public and NGO pressure for agreement (75, p. 730).

Agreement design is intimately connected with the negotiation progress. The desire to negotiate, sign, and ratify an agreement depends on the current terms of debate. States often reject substantive restrictions on their behavior only to sign framework conventions that require ongoing collective decisionmaking that is likely to produce similar, if not more stringent, restrictions. Incorporating financial mechanisms makes potential donors less likely to join but potential recipients more likely to join. Particular decision-making rules, proscriptions, prescriptions, implementation provisions, and withdrawal and renegotiation clauses can all become deal breakers or deal makers. This setting rewards "deft diplomats" who can "add and subtract issues to facilitate the bargaining process, craft the terms of negotiating texts, and broker the deals needed to achieve consensus" (53, p. 23). Although material resources are certainly helpful, high-ranking international, domestic, and nonstate representatives can foster agreement without such resources often simply by tabling compelling proposals (53, p. 23; 74; 75, p. 727; 91, p. 67).

Particularly when exogenous forces make reaching agreement difficult, maintaining political momentum becomes crucial (53, pp. 87; 88). Indeed, the many agreements in certain lineages noted above illustrates how secretariats or individual entrepreneurial leaders can develop, or keep alive, proposals and propose them when conditions become conducive (92). Thus, UNEP Executive Director, Mostafa Tolba, played a crucial role in fostering progress in the ozone negotiations by his careful drafting and introduction of texts at crucial points in the negotiating process (53, p. 119; 68, p. 26). Even the act of holding a meeting can promote agreement because ending the meeting without agreement is so often construed as failure.

As noted, protecting the international environment does not require international law. Indeed, circumventing the state may be quicker, easier, and more open to innovation (93). States sometimes act unilaterally to protect the global environment, funding environmental projects in other countries or sanctioning countries for violating domestic or international environmental standards (76, 94). NGOs and transnational issue networks can engage in world civic politics, using rhetorical persuasion to directly influence the values and behaviors of individuals and corporations (6, 7). Governments, NGOs, and trade groups (and partnerships among them) promote ecolabeling and voluntary codes of conduct, fund debt for nature

swaps, and promote consumer boycotts and buy green campaigns that directly shape corporate incentives (6; 91, p. 66; 95–97).

MAKING INTERNATIONAL ENVIRONMENTAL AGREEMENTS EFFECTIVE: WHY SOME WORK AND OTHERS DO NOT

Ultimately, the value of IEAs is evident not in their negotiation but in their influence on human behaviors that harm the environment. Some environmental problems have improved since relevant IEAs were signed, but others have changed little or become worse. Global production of ozone depleting substances and European and North American emissions of acid precipitants have declined since treaties were signed while many marine ecosystems and fish stocks have deteriorated despite regional and global efforts. Yet, a simple interpretation of this variation (that the former agreements outperformed the latter) is likely to be wrong. It is tempting to interpret continuing environmental decline as failure and environmental improvement as success, to attribute improvements as caused by particular features of relevant agreements, and to promote those features as models for other environmental arenas. And these conclusions may be correct. But they often misinterpret the evidence. First, improvement is preferable to decline, but pressures for environmental degradation are often so strong that success may often only be evident in slower rates of degradation. Second, an IEA's influence requires comparing observed outcomes to what would have happened without the treaty rather than to what did happen before the treaty. Environmental quality and behavior are functions of numerous factors, and improvements often arise from fortuitous economic or technological changes unrelated to a treaty. Third, variation in effectiveness may reflect differences in the problems being addressed, the international context, or other factors that have little to do with the agreements themselves. Identical treaties would reduce ozone depletion and acid rain more than overfishing and marine pollution if the former proved more susceptible to regulation or had conditions that were more favorable than in the latter cases.

Work on the implementation, compliance, effects, and effectiveness of IEAs has been dominated by the study of regimes. During the 1990s, individuals and teams representing differing disciplines, countries, and theoretical approaches examined numerous cases to produce a remarkably coherent research program. By themselves, English-language edited volumes directly evaluating environmental regime effectiveness identify a plethora of factors and forces considered influential (41, 42, 94, 98–101).

Identifying the Effects of Regimes

Identifying an appropriate scale for evaluating regimes proves difficult because regime effects can be so varied. Most work on regime impacts has focused on

whether regimes achieve their desired objectives in relatively direct ways. However, agreements can have indirect, nonobvious, and nonimmediate effects, such as when agreements improve scientific knowledge of a problem and thereby cause governments, corporate actors, and individuals to reassess their interests and adopt less environmentally harmful behaviors. They can have external effects in arenas beyond those targeted by the agreement (41). Indeed, any environmental agreement that causes environmental improvements will also cause corresponding economic changes. The ozone regime all but eliminated a flourishing chlorofluorocarbon (CFC) industry, and many IEAs that establish nature reserves or specially protected areas dramatically alter the lives of nearby residents. Effects can also be characterized as positive or negative (41, pp. 14, 15). Recent conflicts within CITES reflect, in part, concerns that a ban on ivory sales would have been negatively effective and undercut elephant protection by blocking revenues from ivory sales that range state governments could use to prevent poaching and preserve elephant habitat.

Starting with environmental quality, an agreement's explicit environmental goals serve as a useful metrics for evaluating how much a regime helped resolve "the problem that led to its formation" (102, p. 109; 103, p. 366). These environmental goals are useful metrics at times but are often unclear, are hortatory rather than realistic, or may change as scientific understanding improves (102, p. 109). Equally important, analysts may want to evaluate progress toward goals that differ from, or are more ambitious than, those held by the parties (81, 104). Thus, although the whaling convention sought "to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry," some may want to know whether it has promoted a norm of a whale's right to life (105).

Much research to date has focused on changes in behavior rather than environmental improvements. This reflects a recognition that the latter requires the former and that our ability to estimate counterfactuals regarding environmental quality (a product of natural variation, human behavior, and myriad other factors) is even more limited than our ability to estimate counterfactuals regarding human behavior (41, 42, 101, 154). Legal compliance provides a useful initial metric but misses overcompliance and good faith noncompliance that also constitute evidence of regime influence (106). For example, LRTAP's influence was more evident in the otherwise-unlikely 10 percent reductions in Hungarian sulfur emissions than from Nordic reductions that far surpassed the 30 percent requirement but would have occurred anyway (78). The problem, of course, is that regimes may induce significant behavioral change that falls far short of the environmental goals of regime negotiators, let alone the goals held by interested scientists, analysts, or environmental advocates (81, p. 4).

Beyond identifying a scale for evaluation, the analyst must identify a reference point on the scale chosen. Two basic types of reference points have been identified: relative improvement and goal achievement (81, p. 5). The first compares observed outcomes to a no-agreement or no-regime baseline. The second compares them

to the desired value, as defined by regime negotiators (goal achievement) or an independent analyst (collective optimum) (81, p. 6). These standards are complementary: The former, glass half full, criterion asks how far have we come; the latter, glass half empty, criterion asks how far have we yet to go. Several scholars have sought to combine these criteria in a measure of progress that calculates observed improvement from a no-regime baseline as a fraction of total possible improvement from that baseline, a strategy that moves us beyond claims that a regime made a difference toward claims that a regime achieved (or fell short of) its potential (81, 104).

Several additional aspects of regime effects research deserve comment. Research that compares one regime's performance to another's (rather than evaluating a single regime's performance) has begun but faces obstacles in convincingly accounting for differences in how hard problems are to resolve and comparing progress made in noncomparable realms (107). Questions of efficiency, cost-effectiveness, and equity also remain under studied. The plethora of claims regarding what features improve performance under what conditions have still to be carefully evaluated against the empirical evidence (81, p. 8; 102, p. 116; 103, p. 374). And efforts to answer these questions still rely excessively on case studies without sufficient use of other analytic techniques (108).

A Summary of the Effects of Environmental Agreements

A summary of existing analyses clarifies (a) that major obstacles exist to analyzing agreement effects accurately, (b) that only a relatively small subset of agreements have been analyzed, (c) that data exists on a significantly broader range of agreements, and (d) that more careful and systematic comparison of IEA effects is needed. Scholars have analyzed only a small fraction of extant IEAs, in part because the number of IEAs has been consistently underestimated but more because relevant data on behaviors or environmental quality are not readily available. First, finding effects data is difficult because, although some agreements have a single, unambiguous, and obvious behavioral indicator (e.g., the 1973 Agreement on the Conservation of Polar Bears or the 1976 Convention on the Protection of the Rhine Against Pollution by Chlorides), many others target multiple environmental problems (e.g., CITES addresses numerous species, and MARPOL addresses myriad ocean pollutants) or address behaviors that are not readily quantified (e.g., the Wetlands Convention requires countries to "promote the conservation [and] wise use of wetlands"). Second, agreements negotiated in the past 5–10 years are too recent to have had effects that can be evaluated. Third, data useful for distinguishing the influence of regimes from other factors often do not exist or exist but are not well known or readily available. In many cases, data collection begins only after agreements are signed, precluding pre-post analysis. In others, data is not systematically collected with the quality or precision needed. Data relevant to many older agreements may be buried as appendices in obscure reports that prove increasingly difficult to find in an electronic information age. Fourth, relevant data

that do exist often are formatted in ways that discourage analysis. For example, FAO has an extensive database of fish catch (FISHSTAT) broken down by country, year, species, region where caught, and gear used (109). However, using that data to analyze any of the scores of extant fisheries agreements requires identifying which species were regulated in which regions in which years for which countries so that regulated catch can be compared to unregulated catch.

Despite these problems, available data would allow analysis of far more agreements than scholars usually assume. Many IEAs identified here probably do not have the quality and quantity of data needed to support rigorous analysis. But, several hundred agreements could be analyzed using data that exist or that could be developed readily by combining various data sources. FISHSTAT offers opportunities for evaluating the myriad fishery agreements and amendments and for comparing their binding requirements to their many nonbinding recommendations and regulations. Detailed multi-country, multi-year datasets also exist with data relevant to IEAs that address several endangered species, e.g., whales, polar bears, North Pacific fur seals, acid rain, and ozone depleting substances, and various marine and river pollutants. Useful datasets are often available from treaty secretariats; other international, governmental, and nongovernmental organizations; scientists; doctoral dissertations; and published sources. Careful combination and compilation of data from such sources as well as efforts to adopt techniques that would make better and more innovative use of the historical record could provide data useful to analyzing an even larger subset of all environmental agreements (110). Efforts to develop such datasets and analyze them using quantitative techniques have only recently begun (107).

A brief and incomplete summary gives some sense of how the effects of agreements, and assessments of those effects, vary. Most scholars credit the ozone agreements with rapidly reducing production and consumption of CFCs by industrialized countries, despite debate over whether this reflects regulatory, scientific, economic, or political dynamics and despite concern that the effects on developing countries may be less dramatic (87, 111, 112). A 1911 convention to protect fur seals is credited with dramatically reducing harvest and recovering seal stocks (113, 114). One recent analysis has argued that the whaling regime, until 1984, demonstrated "the impotence of . . . IEAs" (115, p. 17); another has argued that the whaling regime has become "quite effective" recently (85, p. 380). Assessments of the LRTAP protocols and pollution of the Rhine suggest they had some influence on behaviors but that many environmental improvements could be better accounted for by factors other than the agreement (78, 116–120). The many MEDPLAN agreements are generally judged as having done little to reduce Mediterranean pollution (73, 121). There are so many fisheries regimes with such different regulatory approaches that, not surprisingly, some appear to have performed quite well, and others appear to have actually made matters worse (122–124). The reader of these and many other assessments is generally left with the sense that evaluating a single agreement well requires sensitivity to complexity and variation and that regimes often have effects that change over time due to institutional change,

change in exogenous factors, may influence one behavior or set of actors, but have no influence on other behaviors or actors (125).

This dynamic and multifaceted character of effects has been highlighted by projects that explicitly have tried to compare the effects of different regimes and the responses of different countries to different regimes (41, 42, 98, 101, 126, 154). A study led by Brown Weiss & Jacobson of five regimes concluded that the regimes related to ozone protection and ocean dumping of radioactive wastes (the London Dumping Convention) were more effective than those related to the 1972 World Heritage Convention and the 1982 International Tropical Timber Agreement (127, pp. 515, 516). Another study led by Miles & Underdal examined 14 regimes (each composed of multiple agreements) and found that more than half achieved significant or major behavioral improvements relative to the no-regime counterfactual during one or more time periods. They also found, however, that almost 60 percent were not particularly effective in "accomplishment of functionally optimal solutions" (128, p. 435). Like Brown Weiss & Jacobson, they deemed the regimes on ozone protection and ocean dumping of radioactive waste to be quite effective and had similar evaluations of the regional regimes protecting the North Sea from dumping by ships and aircraft and managing tuna fisheries in the Central and Southwest Pacific Ocean (42). They also found that the MEDPLAN, MARPOL, the whaling regime, and the 1980 Convention on the Conservation of Antarctic Marine Living Resources were not particularly effective at inducing behavioral change. Regimes related to LRTAP, protection of the North Sea from land-based pollution, and management of salmon in the North Pacific were found to have produced mixed results. Although both these studies judged CITES as being less effective than other agreements, several more detailed evaluations have judged its impacts quite favorably (128a, p. 26; 128b). The judgments made by these researchers, and particularly conflicting judgments such as those regarding CITES or the whaling regime, highlight (a) the difficulty of assessing agreement impacts, (b) the difficulty of comparing impacts, and (c) how much those impacts depend on the standard used by the analyst (117, p. 233). They also suggest that summary claims about regime effects may be less valuable than more nuanced claims about particular effects of interest during particular regime stages. That said, the literature as a whole suggests that some regimes fail quite miserably, others do reasonably well, but very few fully and permanently resolve the problems they address (128, p. 435).

The Determinants of Regime Effects

To say that IEA effects are evident in changes in behavior or environmental quality is not to say that they are the only sources of such changes. Any behavior that can be influenced by an agreement is also subject to many other influences. Changes in treaty-regulated behaviors are often due to factors other than the treaty. Even the strongest supporter of international environmental law would recognize that agreements, however well designed, are not always the cause of good outcomes.

The political science literature to date has focused on how regimes influence the environmental behaviors of states, but it could benefit by framing the question as what explains variation in the environmental behavior of states? This subtle shift directs our attention to the many nonlegal drivers of environmental behaviors that are often arrayed against international environmental agreements but sometimes facilitate their efforts. Environmental economists have done considerable research into factors that explain variation in pollution across countries, factors that have often been ignored when evaluating IEA effects (129). Including economic, technological, political, and other drivers of behavior as explanatory variables in an analysis allows their use as control variables and demonstrates that covariation between an IEA and some outcome persists even after controlling for other factors. This also allows assessment of whether an IEA's influence depends on, and is large or small relative to, these other influences. The plethora of factors hypothesized as driving environmental degradation can be categorized into four groups: characteristics of the country, the international context, the environmental problem, and the agreement (127). Cutting across these categories run distinctions between domestic and international factors and among economic, political, social, and demographic factors.

Both theoretical considerations and empirical evidence suggest that characteristics of the environmental problem explain the likely effects of an agreement on a given behavior but also explain variation in those behaviors (over time, across actors, and across problems) that have nothing to do with agreements (127, p. 521). At the simplest level, countries that are ecologically vulnerable and have low adjustment costs tend to be more responsive to agreements while those that are not affected ecologically or have high adjustment costs tend to be more recalcitrant (77). Problems whose resolution requires new behaviors tend to face violations owing to incentives and incapacity, whereas those that require restraint tend to face only violations owing to incentives. Environmental problems differ in how willing and able relevant actors are to alter their behavior and, hence, how difficult it will be to induce conformance with regime rules (42; 81, p. 1; 101; 102, p. 117). Market structures can reinforce or undercut regulatory efforts—the recovery of fur seals in response to the 1911 agreement owed much to the ease of monitoring that stemmed from London being the only major market for skins (113). Marine pollution agreements benefit from the incentives shipbuilders and ship insurers have to monitor and enforce them, but international endangered species agreements create shortages and price increases that encourage smuggling that undermines their effectiveness (71; 127, p. 521). The major threats to agreements that address tragedy of the commons situations involve efforts to cheat clandestinely; the success of such agreements often requires stringent compliance monitoring to identify cheating. The major threats to agreements that address upstream/downstream situations involve perpetrating states threatening victims with violations unless they receive more compensation for their cooperation; such extortion attempts are, by definition, public and so compliance monitoring is less crucial to these agreements (130).

Other important problem characteristics include the number of actors contributing to a problem, levels of uncertainty about the problem or its resolution, the role and position of corporations, and the concentration of the activity being regulated (127, figure 15.2). Variation in these factors can cause changes in behaviors independent of any agreement. New knowledge of a behavior's environmental impacts will, even without an agreement, reduce such behaviors if their damage imposes large and immediate costs on those engaged in the behavior or on others who have influence over those who engage in the behavior. Polluting behaviors often decline if environmentally friendly technologies become economically attractive, whereas extractive behaviors (e.g., fishing or whaling) tend to be less responsive to technological developments because environmental damage is more inherent to those behaviors. Social and cultural commitments to an activity and economic inertia can create resistance to change, as evident in the difficulty of reducing whaling by countries with cultural commitments to it, such as Norway, or reducing dependence on fossil fuels in most developed states.

Country characteristics explain why countries vary in their environmental degradation and in their responsiveness to agreements. Indeed, economic research has sought to explain pollution levels by reference to country characteristics, such as economic indicators, political and policy indicators, and demographic and social indicators (129, 131–133). Political scientists note the importance of relatively stable forces, such as history and culture, geographic size and heterogeneity, resource endowments, and the number of neighbors; more variable factors, such as level of development, type of government, the role of environmental parties, and attitudes and values; and quite immediate drivers, such as changes in administrative and financial capacity, leadership, NGO activities, and knowledge and information (127, p. 535; 134–137). These factors drive environmental behaviors independent of agreements but also influence the ability and willingness of states to implement international commitments. Marine pollution agreements had little influence on tanker owners and operators when their flag states were the only ones with enforcement rights; they became far more effective after amendments extended enforcement rights to port states that were both more concerned and more able to enforce them (71). Incapacity has been shown to be a major reason that many countries, particularly developing ones, fail to fulfill their environmental commitments (98, 127). And, incapacity problems are worse for agreements that must invoke positive expenditures of resources rather than simple requirements of restraint.

Characteristics of the international context tend to explain major shifts in environmental practices (127, p. 528). The end of the Cold War, the start of the war on terrorism, global economic booms or recessions, large-scale shifts toward democratic governance, and development of new technologies can alter how, and how much, countries protect the environment. Globalization can both encourage environmental protection and hasten environmental degradation (138). The increasing attention of global media and the public to environmental problems has led

individuals, corporations, and countries to adopt behaviors and design technologies that produce less environmental harm. That attention is promoted by international conferences, such as the 1972 UN Conference on the Human Environment, the 1992 UN Conference on Environment and Development, and the 2002 World Summit on Sustainable Development, and by major scientific reports on such problems as climate change, biodiversity, or ozone loss (69). NGOs, such as Worldwide Fund for Nature and Greenpeace, and intergovernmental organizations, such as UNEP and the World Bank, have led countries to focus on environmental problems and provided financial and informational resources to address them. These forces also overlap and interplay with agreement features (139, 140). Indeed, although the increasing density of environmental agreements may foster the ability of each to achieve its objectives, there are competing views about whether integrating all environmental agreements into a global environmental organization would facilitate or impede environmental progress (141, 142).

Characteristics of the agreement constitute the influences on environmental behaviors of most interest (127, p. 523). Were realist theory always correct, then characteristics of the problem, countries, and international context would determine behavioral outcomes (143, 144). Institutionalists have shown, however, that regime design and problem-solving capacity also influence outcomes (81, p. 1; 145). Indeed, the time spent negotiating IEAs reflects the assumption that the outcomes achieved depend on agreement design, not just the exogenous factors just delineated. What follows attempts to make sense of the "plethora of propositions as to which types of institutions are likely to be more effective" (103, p. 374).

The social and political process of defining the problem, and the strategies and aggressiveness with which it is addressed, condition an agreement's effects because they determine the costs, obstacles, and resistance to achieving it (54, 146). Aggressive goals may motivate significant behavior change by those who try yet fail to meet them, or they may be ignored as unachievable (54, 147). More realistic goals may achieve visible results quickly but may provide few incentives for actors to do more. The means chosen also surely matter, but even simple questions, such as whether binding agreements induce more change than nonbinding resolutions, remain open (34). Clear regulatory rules may seem crucial to behavioral change, but we do not yet know how regulatory regimes compare to procedural regimes that facilitate recurring collective choice, programmatic regimes that pool resources toward collective goals, or generative regimes that develop new norms (53, p. 145; 102, p. 24). The conditions for success of regulatory regimes have been more fully specified, however, if only because their explicitness makes measuring their effects easier.

Regulatory regimes induce compliance through primary rule systems, information systems, and response systems (106). Effective regimes design these systems so they fit the environmental and behavioral demands of the problem. Regime designers must choose among behavioral prescriptions and proscriptions. Deciding which activity to regulate dictates which actors with what interests and capacities

must change their behavior, how large and costly those changes will be, and whether other factors will reinforce or undercut compliance incentives. Designing more specific rules clarifies what is expected for those predisposed to comply and removes the opportunity to claim inadvertence or misinterpretation for those predisposed to violate (148). Even perceptions regarding the fairness of rules can influence their effects (127).

Regimes can increase their effects through choices regarding information systems. Regulating highly transparent activities or those that involve transactions between actors can reassure each actor that others are complying and allow them to protect their interests if they are not. Although most regimes rely on self-reporting systems, those that supply incentives and build the capacity to report appear to work better than others that sanction nonreporting or fail to address practical obstacles to reporting (149). Intrusive monitoring systems have been authorized in several environmental agreements, and rising environmental concern may make them more common.

A regime's influence also depends on how it responds to compliance and violation. In trade and arms control treaties, strategies of direct tit-for-tat reciprocity are likely to be both used and effective: Member states have incentives to raise tariffs on states that violate tariff rules and to build more missiles if other states violate a weapons limitation, and those responses, if carried out, are costly enough to deter many violations (150). In environmental realms, such strategies are less useful because regime supporters are generally unwilling to harm the environment in retaliation for a violation, and even if they did so, such actions would have little influence on those unconcerned about the environment. Recognizing this, many have stressed the need for treaties to couple economic sanctions with careful monitoring and verification mechanisms to trigger them (103, p. 363; 151; 152). Chayes & Chayes argue that such enforcement is less effective than compliance management using diplomacy, norms, and rewards (148). Empirical research has yet to resolve whether enforcement trumps management and, if so, under what conditions (152). Systems of implementation review, sunshine methods, eco-certification, and prior informed consent have also been used by various IEAs to induce behavior changes (127, 101). Norms unsupported by sanctions or rewards, e.g., the Wetland Convention's "wise use" requirement, can foster dialogue and discussion, which in turn may alter perceptions of (and engagement in) appropriate and inappropriate behaviors (153). Crucial questions remain regarding which of these (and other) strategies work best in which circumstances, once the analyst has controlled for characteristics of the issue area, international context, and actors.

The Endogeneity Problem

Evaluating IEA influence not only requires evaluating these competing explanations but poses a final, challenging endogeneity problem: The factors that drive environmental behaviors also determine the agreements that states negotiate as well as which states join agreements once they are concluded. Such factors offer a rival

explanation for any purported IEA influence. Agreements are signed only by those states that are ready to limit environmental harm—and only when they are ready to do so. Therefore, by definition, but for reasons unrelated to IEAs, the activities of member states will differ both from their prior behavior and from that of nonmember states. Cases where different treaty provisions correlate with behaviors or environmental quality may be mere reflections of underlying differences in the problem being addressed or other factors. Thus, changes in economic interests may produce pressures to negotiate an agreement and to change behaviors. Highly interdependent (e.g., European) states may adopt more ambitious agreements and change their behavior more readily than less interdependent states. Empirical research on IEA effects faces several such obstacles that require careful theorizing and the use of analytic techniques that are available but are only beginning to be applied to the task.

CONCLUSION

If an IEA is defined as an intergovernmental document intended as legally binding (whether an original agreement or a modification thereto) with a primary stated purpose of managing or preventing human impacts on natural resources, over 700 multilateral IEAs can be identified. Although more difficult to identify, there are more than 1000 and perhaps as many as 2100 BEAs. MEAs break down into about 250 lineages of legally linked agreements, though almost 40 percent of agreements fall into only 20 distinct lineages with many other lineages consisting of only 1 or 2 agreements. Several IEAs were already signed by 1900, and agreement adoption has increased steadily to the point that currently an average of over 20 MEAs and 30 BEAs are signed each year. Among MEAs, an initial focus on species protection has increasingly been balanced by concern with pollutants and, more recently, with habitat protection.

Whether governments are willing to negotiate and join IEAs depends on a range of factors, including the magnitude, likelihood, and distribution of the consequences of an environmental problem; the environmental, economic, social, and political effects of taking or not taking action on the problem; the way those effects are distributed across countries; the way different sectors within those countries perceive the costs and benefits of those effects; each country's inclinations regarding whether and how to respond to such threats; and the general and issue-specific power countries have to promote or restrain international agreement. Crises involving environmental disasters or breakthroughs in scientific understanding can foster agreement where it might otherwise be unlikely. In understanding global efforts on climate change, regional efforts on air pollution and fisheries, or bilateral efforts on river and lake pollutants, these and related factors go far to explain both the positions of individual governments and the ebb and flow in the success and failure of negotiations.

Deciphering whether IEAs, once signed, change the behaviors of governments, corporations, and individuals in ways that improve the environment also poses

challenging analytic tasks. The effects and effectiveness of most environmental agreements have yet to be carefully analyzed, but research to date has identified considerable variation in their effectiveness. Agreements on stratospheric ozone depletion, dumping of wastes in the North Sea, and dumping of radioactive wastes globally are some of those that have been judged as quite influential; those addressing the world's natural and cultural heritage, tropical timber, and many fisheries have usually been judged as less effective (42, 124, 154). But such judgments of these and other agreements depend considerably on the criteria used to evaluate effectiveness and on the analyst's skills in estimating what would have happened without the agreement. Research to date has demonstrated that, although the inclusion of specific design features in particular IEAs can sometimes make them more effective, whether any particular IEA design is effective also will depend on a wide range of other variables and parameters including characteristics of the countries involved, the environmental problem being addressed, and the international context (127).

Treaties, conventions, and other legal agreements among governments will be important features of global environmental governance for the foreseeable future. Policymakers will want to develop IEAs to address new environmental problems in the future and redesign existing IEAs that are performing poorly in the present. Scholars have begun to address these policy needs; they have shed light on the factors that foster and hinder intergovernmental negotiation and that lead some IEAs, once concluded, to perform well and others to perform poorly. But greater efforts to answer existing questions and pose new ones, to employ a broader range of methodologies, and to use evidence from more of the extant MEAs and BEAs than have been studied to date will allow researchers to advise policymakers more confidently and more effectively in the future.

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database and links to all web-based sources cited in this review will be maintained at Reference 31.

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